

**BLISTER PACKAGE WITH ELECTRONIC CONTENT MONITORING SYSTEM**

This invention relates to a packaging device and a content use monitoring system and, more particularly, to a preformed backing sheet carrying electronic circuitry for use with a packaging device and a content use monitoring system that is primarily adapted to medication packaging and dispensing.

**BACKGROUND OF THE INVENTION**

Medications comprise a large component of health care. A limiting factor to the effectiveness of many medications is patient compliance with the prescriptions. Medications typically must be taken at specific intervals based on their pharmacokinetics to maximize plasma levels, and any substantial deviation from the prescribed interval may result in ineffectiveness or adverse effects. As the patient population ages, the incidence of medication errors increases.

A prior invention by Wilson and Petersen as disclosed in Canadian Patent Application No. 2,353,350 of July 20, 2001 describes a packaging device for monitoring use of the contents of blister packages. The packaging device comprises a package, an electrically conducting path and an electronic chip embedded in, or supported by, the package. The package has one or more sealable receptacles for accommodating contents. The electrically conducting path is associated with each receptacle. It changes its characteristics when the receptacle is opened after being sealed. The electronic chip monitors the change in the characteristics of the conducting path, and generates content use data when the change in the characteristics of the conducting path is detected.

One practical difficulty with the Wilson and Petersen invention is that the electronic traces which establish the electronic path must be oriented accurately relative to the blisters or receptacles, between the contents and the lidstock or backing. A second difficulty lies in connecting the electrical traces to the electronic chip, which incorporates an integrated circuit (IC). A third difficulty lies in the necessity of redesigning widely used form-fill-seal machines to carry out these functions.

It is desirable to have a simpler solution to the integration of electronic monitoring devices with the blister package, preferably so that widely existing form-fill-seal machines can still be used with little or no modification thereto.

**SUMMARY OF THE INVENTION**

The present invention relates specifically to the mounting of replicates of an electronic inventory control device for blister packaging on rolls of lidstock (backing) which can then be

used to seal blister packaged medications or other contents by standard form-fill-seal devices.

The invention comprises replicates of a suitable integrated circuit (IC), a power source, and an electrically conducting trace system mounted on lidstock in such a way that the lidstock can be used with standard or only slightly modified form-fill-seal machinery to form a blister package. Each replicate encompasses an area of lidstock of dimensions appropriate for the desired blister package. On either the top or the bottom surface of the lidstock is located a pattern or a grid of electrically conducting traces each ultimately terminating at a contact of the IC, which has its own power supply, clock and non-volatile memory, and which is also attached to the lidstock. When attached to the package, each trace in one embodiment is designed to correspond to or to intersect a single blister of the package. When the contents of the blister are expelled though the backing the associated trace is broken. The IC tests the integrity of the traces at specified intervals and records the time of detection of a newly broken trace in the non-volatile memory.

In a second embodiment of the invention the traces are arranged in a grid without concern as to having each trace intersect a single blister. The grid is composed of a relatively large number of traces such that several traces of the grid will intersect each blister. When the contents of a blister are expelled therefrom the grid, rather than an individual trace, would be broken, causing a change in the resistance of the circuitry. This change in resistance would be recorded in the non-volatile memory of the IC as a timed event. By using the grid arrangement the need to align individual traces with the blisters is obviated and the positioning of the replicate relative to the package becomes less critical to effective operability. A replicate using a grid arrangement would have more universal applicability as the same design could be used with a large variety of different packages.

The information can be retrieved from the IC's memory at a later time by any suitable means, such as a non-contact reader, and displayed or analyzed as required.

Other aspects and features of the present invention will be readily apparent to those skilled in the art from a review of the following detailed description of preferred embodiments in conjunction with the accompanying drawings.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

The invention will be further understood from the following description with reference to the drawings in which:

FIG. 1. Is a perspective view showing a roll of lidstock with a plurality of replicates of this invention thereon;

FIG. 2. Is a schematic view of a single replication of the integrated circuit and electrically

conducting traces;

FIG. 3. Is a schematic view of a single replication of the integrated circuit and electrically conducting traces in relation to the position of the blisters;

FIG. 4. Is schematic cross sectional view of the blister package including the backing with its integrated circuit and electrically conducting traces;

FIG. 5 is a rear perspective view of another form of blister package incorporating the present invention;

FIG. 6 is a front view of the rear flap of the package of Figure 5 with a replicate of the present invention thereon;

FIG. 7 is a partially broken away front view of the package of Figure 5 showing the replicate captured between two layers of the rear flap of the package; and

FIG. 8 is a schematic representation of a single replicate of this invention with an electrically-conducting grid associated therewith.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, replicates 10 of the electronic inventory control device of this invention are attached to a roll 12 of backing (lidstock) designed for blister packaging. FIG. 2 depicts a first embodiment of the invention wherein each replicate 10 comprises a network of electrically conducting traces 14 terminating on the contacts 16 of an integrated circuit (IC) 18 containing a power supply, clock, and non-volatile memory (not shown). The traces 14 are oriented so that each trace corresponds to the position of a blister 20 (FIG. 3) and so that expelling the contents of the blister through the backing will break the trace. At programmed intervals, the IC 18 samples the integrity of the traces and records the time that a broken trace is detected in its non-volatile memory.

The replicates can be mechanically attached to the backing 12, printed on the backing 12 (as by silk screening for example), or a combination of both techniques can be used. They can be located on either surface of the backing 12 (i.e.: inside or outside in reference to the blister package). The backing 12 may be a single sheet of material as shown or it may be a multi-layered laminate. In the event that a laminate is used, the traces may be sandwiched between layers of the laminate.

The IC 18 may be, but is not limited to, a standard smart card IC attached to the backing 12 in such a way as to have its terminal coincide with the ends of the electrically conducting traces 14. It may also be printed on the lidstock using emerging thin-film technology.

The power supply may be, but is not limited to, an integral part of the IC 18. It may be of conventional design as used for smart cards and similar applications or it may be printed

directly on the backing. The IC can be of the digital or the analog variety and can employ volatile memory as well as the preferred non-volatile memory mentioned herein. The IC can be adapted for use with infrared, and radio frequency, proximity and contact reader systems to facilitate the downloading of event information as recorded in the memory of the IC.

5           The traces 14 can be made of any electrically conducting material affixed to or printed on the backing.

Also included in the invention is the use of an adhesive lidstock that can be applied to the back of an already finished blister package to allow for inventory control as described using already packaged contents.

10           Figures 5 and 6 illustrate another type of package that can benefit from the present invention. Therein a foldable package 20 has a front flap 22 which may carry product information, a spine 24 to which the front flap is attached along fold line 26, and a second or rear flap 28 which is hingedly attached to the spine 24 along fold line 30. The rear flap 28 carries a plurality of blisters or receptacles 32 on the inside surface thereof, which blisters are normally  
15           protected by the front flap 22. The outside surface of the rear flap has a plurality of openings 34 therethrough in alignment with the blisters 32, each opening being covered by a thin layer 36 of a frangible material. Secured to, preferably, the inside surface of the rear flap is a replicate 38 of the present invention which includes an electronic chip 18' incorporating an integrated circuit, a power source and a non-volatile memory, and a plurality of traces 14' which intersect  
20           the blisters 32. The chip and the traces will be protected by the front flap 22 in the normal condition of the package.

When the front flap is lifted the blisters are exposed and the contents of a selected blister can be pushed through the frangible material 36 at the rear surface. Preferably, as shown, the traces 14' will intersect the openings 34 such that each trace intersecting an opening will be  
25           disrupted when the contents of the associated blister are pushed through the frangible material 36. This causes the detectable change in characteristics referenced hereinabove, which change is stored in the non-volatile memory for later downloading.

If the rear flap of the package is formed of more than one layer of material then the replicate carrying the electronic chip 18' and the traces 14' could be located between two of the  
30           layers so that it would be hidden from view. This is shown in Figure 7 wherein it is seen that the blisters 40 are secured to the inside surface 42 of the rear panel 44 of the rear flap and project through openings 46 in the front panel 48 of the rear flap. The replicate 38 is in turn secured to, preferably, the inside surface 42 of the rear panel 44 so that it is sandwiched or captured between the front and rear panels 44, 48 during final assembly of the package as it flows  
35           through a form-fill-seal packaging machine.

While the IC 18' is illustrated in Figures 6 and 7 as being located on the same flap 28 as the traces 14' and the blisters 32 it could just as easily be located on the flap 22, separated from the blisters and connected via traces which extend over the spine 24 to the traces 14' which intersect the blisters. This configuration would be used when the entire flap 28 is covered by blisters and there is no room on or in the flap for the IC itself.

Figure 8 illustrates yet another embodiment of the present invention wherein the individual traces 14, 14', which must be positioned so that each intersects a corresponding blister, are replaced by a fine mesh-like grid 50. The grid 50 is made up of sets of electrically conducting traces 52, 54 with the traces 52 intersecting the traces 54 at right angles. The spacing between individual traces within each set is considerably less than the spacing between traces in the other embodiments, the result being that each blister will overly several of the traces making up the sets 52, 54. The sets 52, 54 are in turn connected by traces 56, 58 to the IC 18". Whenever the contents of an individual blister are expelled therefrom the plurality of traces therebelow will be ruptured, causing a change in the resistance of the circuit, which change is recorded in the non-volatile memory of the IC 18" for later downloading. With this embodiment the need to accurately align blisters and traces, to ensure that each blister is associated with a corresponding single trace is obviated.

The foregoing has described the present invention and several means of putting the invention into effect. It is understood that the invention can be effected in a multitude of different ways without departing from the spirit of the invention. Accordingly the protection to be afforded this invention is to be determined from the scope of the claims appended hereto.